Form 11
April 1907
GREAT BRITAIN

FACTORY AND WORKSHOP.

David J. Young.

REPORT

TO THE

SECRETARY OF STATE FOR THE HOME DEPARTMENT

BY

H. H. S. CUNYNGHAME, Esq., C.B.,

ASSISTANT UNDER-SECRETARY OF STATE,

AND

B. A. WHITELEGGE, Esq., C.B., M.D.,

H.M. CHIEF INSPECTOR OF FACTORIES,

ON THE

Match Factory of Messrs. Moreland & Sons, Gloucester, with special reference to a recent fatal case of Phosphorus Necrosis.

Presented to both Houses of Parliament by Command of His Majesty.

LONDON:
PRINTED FOR HIS MAJESTY'S STATIONERY OFFICE,
By DARLING & SON, Ltd., 34-40, Bacon Street, E.

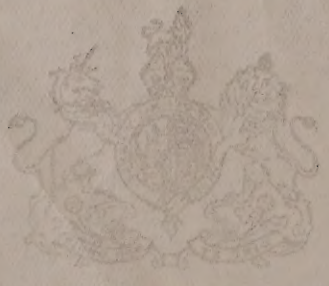
And to be purchased, either directly or through any Bookseller, from
WYMAN and SONS, Ltd., Fetter Lane, E.C.,
and 32, Abingdon Street, Westminster, S.W.;
or OLIVER & BOYD, Edinburgh;
or E. PONSONBY, 116, Grafton Street, Dublin.

1907.

[Cd. 3373.] *Price* 1*d.*

WELLCOME HISTORICAL MEDICAL LIBRARY

E



WELLCOME INSTITUTE LIBRARY
Coll. | welMOmec
Call No. | 4 pam WA 400 1907 C97r

22501255619

REPORT

TO THE

SECRETARY OF STATE FOR THE HOME DEPARTMENT

BY

H. H. S. CUNYNGHAME, Esq., C.B.,

ASSISTANT UNDER-SECRETARY OF STATE,

AND

B. A. WHITELEGGE, Esq., C.B., M.D.,

H.M. CHIEF INSPECTOR OF FACTORIES,

ON THE

Match Factory of Messrs. Moreland & Sons, Gloucester, with special reference to a recent fatal case of Phosphorus Necrosis.

Sir,

We visited the match factory of Messrs. Moreland & Sons, at Gloucester, on February 14th.

This factory employs 640 hands, of whom 256 are engaged in the boxing of dry matches, of which a large quantity are made with yellow phosphorus. Safety matches and "strike-anywhere" matches made without white phosphorus are also manufactured.

We gave attention first to the phosphorus dipping department, in connection with which a fatal case of phosphorus necrosis had recently occurred.

The process of dipping the splints into phosphorus paste so as to form the heads of the matches is performed in two semi-automatic machines. The number of persons attending each machine is not more than six, of whom only three are at the end of the machine where any phosphorus is employed ; but at each machine enough matches are dipped to occupy a large number of persons in the subsequent processes of boxing and packing.

The machine consists of a long railway, on which travel a continuous series of frames of wood containing the splints, which are to form the sticks of the matches. These project downwards from the frames like bristles from a brush. The frames are impelled along the railway by little arms that push them. On the way they are first dipped into melted paraffin. This operation, which entails no danger, is watched by an attendant, who from time to time puts more paraffin into the liquid bath. The frames then travel on until they arrive over one half of a circular revolving iron table kept covered with a thin layer of sticky phosphorus paste. This paste, which is a mixture of warm glue, white phosphorus, chlorate of potash, and other ingredients is, as required, poured by hand on to the table out of a ladle.

As the table revolves a "straight edge" spreads the paste into a layer about a quarter of an inch thick. Successive portions of the table are brought under the frames from which the splints project, and when in this position the table stops for about two seconds for each frame. During its stoppage a lever presses the frame downwards so as to bring the splints firmly into contact with the table. This has two effects—it causes the ends of the splints to come into

250 Wt 2013 4/07 D & S 4 28139r

general alignment, and at the same time deposits a drop of the sticky paste upon each of them. Each frame rises up, then travels on, and is removed by hand from the railway, and slid into horizontal grooves in waggons which, when full, are wheeled away to the drying room.

It follows from what has been stated above that the places from which phosphorus fumes arise are : First, the table, which is about six feet in diameter, and secondly, the pot containing the supply of phosphorus paste which is kept warm by a steam jacket. Over the whole of the table and the pot there is a hood, with exhaust draught, made as to the upper part of sheet-iron and provided at its lower part with a series of glazed windows, hinged above and hanging down to about the level of the chests of the operators, who thus are kept away from the fumes, provided the draught of air up the hood is sufficiently brisk.

At each table the up-draught was efficient. Smoke created by artificial means was immediately sucked up with considerable velocity, and we cannot see how the fumes could come into the nostrils or mouths of the operatives.

The work in which the operatives at or near the dipping tables were engaged was as follows :—One of them, as the table revolved, picked up any matches which had slipped from the frames on to the paste, using for this purpose an implement very like an ordinary wire toasting fork. Another poured the mixture upon the table, and a third (at some distance) removed the frames and put them in the waggons. These three were the only persons who, we think, could be exposed in any way to danger from the phosphorus, apart from the men who mix the paste and carry it to the dipping table.

As we have stated, the heads of those employed at the table were in such a position with regard to the hood that it seemed impossible that they could inhale any of the fumes. But at one of the machines we found their hands smeared with phosphorus paste in quantities which must be a source of danger ; while at the other machine the persons removing the matches and ladling the paste had perfectly and scrupulously clean hands. At both machines the hands of the person removing the frames and putting them in the waggons were smeared with phosphorus.

It will be seen that the machine we have described is not entirely automatic. The actual processes it is true were performed by automatic machinery, but the removal of the stray splints, the pouring of paste on the table, and the removal of the frames, were effected by hand labour.

So far as fumes are concerned there seems to be little, if any, risk under existing conditions, but it would obviously be a great advantage to dispense with hand labour altogether. As far as we can see the difficulty of making the whole process automatic is not insuperable, but in order to effect this object probably the whole of the frames and frame-filling machinery at present in use would have to be discarded, and some trouble would probably be experienced in devising effective automatic means for putting the paste upon the table. Very considerable expense, possibly thousands of pounds, would be incurred.

In another part of the works the dipping, drying, and boxing are done automatically in the manufacture of non-phosphorus matches, in a self-contained machine which could be ventilated by exhaust, although the paste has still to be spread by hand. We understand that this machine has not yet been found suitable for the manufacture of phosphorus matches, but the firm hope to be able to overcome the difficulties.

There is one hand dipping table of the old type, with an exhaust hood ; but it is only occasionally used.

The recent case of necrosis was that of Thomas Davis, who had been employed for about twelve years at a match factory (closed in 1901) in Ireland, in mixing and boxing. In 1900 he came to Messrs. Morelands' as labourer. A trivial accident there in November, 1902, caused fracture of the leg, and as it would not " set," amputation at the thigh became necessary. The operatives

of the firm being insured in an insurance company, he received from the insurance company a sum of money which he accepted in lieu of all claims. We are not sufficiently acquainted with the circumstances to say how far this sum fairly represented what he may have been entitled to, but the firm arranged with him, on condition of his investing this sum, to give him work as long as he was able to do it. In October, 1903, they set him to work at the dipping table in removing splints with the fork. He sat in one position throughout the usual hours of employment. He had been regularly examined by the appointed dentist. He had contracted an inveterate habit of chewing tobacco, and his infirmity rendered it difficult for him to leave his position at the dipping table even to wash his hands when soiled; so that having regard to the conditions under which he worked it seems probable that phosphorus may have been conveyed to the mouth by the hands. We cannot but think that the selection of this particular employment for such a man was regrettable.

On the 26th October, 1906, a tooth was extracted; he resumed work after $3\frac{1}{2}$ weeks on the 19th November, 1906. On the 12th December, 1906, he was again suspended on account of a slight swelling. A week later a tooth had become loose, and on extraction of this necrosis was found. He was treated at home by a surgeon appointed by the employers, but died on the 19th January, 1907.

Davis had been long engaged in the phosphorus match industry in the old days when but little care was taken, and it is recognised that phosphorus necrosis rarely results except after exposure of years, and that long exposure predisposes to necrosis even in persons who are no longer exposed. A condition of brittleness of bones, leading to necrosis, or fracture, on slight violence even without present exposure to phosphorus, has been described in connection with phosphorus workers, and the circumstances of the accident to Davis suggest that it may have been an instance of this kind. It is, however, to be regretted that abstinence from chewing, and cleanliness of hands, were not enforced by the foreman in charge of the machine. There is no Special Rule forbidding the chewing of tobacco in phosphorus match factories. The rule as to washing hands only applies to the time when the man leaves work. We think these omissions should be remedied. We suggest further that the man at the dipping table should (at all events experimentally) be provided with gloves of such a character that the paste cannot penetrate them, and that the gloves should be cleansed or renewed as soon as they become soiled.

We are glad to say that the firm met us in a very proper spirit, and appear to be genuinely desirous to do anything they can to diminish the evil. They have for some time past voluntarily caused the dental examination to be made monthly, although the Special Rules require quarterly examination only, and have undertaken at once—

1. To employ none but adult males at the dipping tables.
2. To provide gloves for the workers about the dipping tables.
3. To improve the character of the fork with which the stray splints are removed from the table.
4. To cause sawdust to be spread upon the floor, and to be removed and renewed as required.
5. To forbid the chewing of tobacco in the works.
6. To arrange for the inspection of the hands of the operatives so that they may be kept scrupulously clean, during work as well as on leaving the factory.

Short of the abolition of the use of white phosphorus or of making the machines completely automatic, we cannot see that there is anything else that can be done.

We are able to report that in the present instance no rules appear to have been broken. On one recent occasion the use of the mouth wash provided

for the operatives was reported to have been somewhat neglected; on another, complaint was made by the Certifying Surgeon that the washing place was not clean, and on a third there had been resistance on the part of certain operatives to the wearing of overalls required by the Rules; but these have now been remedied and we do not think there is any ground for a prosecution.

We examined also the the other parts of the factory, including the mixing and boxing rooms. In the mixing room the work is intermittent and conducted in accordance with the Rules. The paste is kept in covered vessels, and carried to the dipping tables as required.

In the boxing room the matches are boxed in the dry state, and the Rules do not require exhaust ventilation of the stalls at which this work is done. This has, however, been introduced voluntarily by the firm as an additional precaution, and with great advantage in keeping the air of the room free from the smoke arising from the small accidental fires which are frequent and inevitable. We suggested some improvements in the arrangements for ventilation, and experiments are being made at the factory with a view to them, under the direction of Mr. Pendock, one of His Majesty's Inspectors of Factories and Secretary of the Departmental Committee on Ventilation.

It would seem that the explanation of the recent exclusive incidence of necrosis upon this one factory cannot be found in the present conditions of work. In our opinion the previous employment under conditions involving far more exposure to phosphorus than can occur now, is a most important factor in the causation of the necrosis in the more recent cases. This predisposing cause is shared by other old employees in these works and elsewhere, and hence notwithstanding the thorough precautions now taken it would be unsafe to assume that no further attacks will occur among the older hands—even if the work in phosphorus were entirely discontinued. But under present conditions the chance of this lessens year by year as younger hands (never exposed in the old way) are brought in. This is confirmed by the immunity in recent years of all match factories except Messrs. Morelands', and the absence of necrosis in the works in which the phosphorus is made.

It has to be remembered also that in some of the recent cases the habits of the sufferers, and in one instance a direct breach of the Rules on their part, added unnecessarily to the risk.

Arrangements are being made for an enquiry and report by an expert with regard to the dental examinations in all phosphorus match factories, and this may result in further improvements in that direction. Frequent visits are paid by the Inspectors to the works in question. The Report of the Ventilation Committee, to be issued very shortly, will be of service in connection with the exhaust draughts.

Many manufacturers, and Messrs. Moreland among them, have spent considerable sums of money in the endeavour to make a strike-any-where match without white phosphorus, but in spite of various inventions, some of which are strongly advocated by those who have patented them, it does not seem that they are yet in a position entirely to replace the white phosphorus match.

Custom no doubt has some influence, and it is also said that matches made with white phosphorus have the advantage of greater resistance to damp and greater freedom from explosive ignition, not only in manufacture but also in use by the consumer.

To whatever causes we are to attribute it, the fact remains, that white phosphorus matches are in considerable demand both in Great Britain and abroad.

It would, of course, be easy, and would relieve the Factory Department of much trouble, to put an end to the possibility of necrosis by totally prohibiting the use of white phosphorus.

But this step would seem logically to involve the prohibition of the use of many other substances which are largely used in industry, and which have caused a much larger number of industrial accidents.

The effect of prohibition would probably be to throw out of employment a number of workpeople who are at present not suffering from any disease and who might have a difficulty in finding employment elsewhere.

Moreover such a prohibition would involve the prohibition of the introduction into Great Britain of white phosphorus matches, as is pointed out and discussed in the Memorandum on the International Conference at Berne (Cd. 3271, 1906).

Each industry must be considered on its own merits and with reference to its special circumstances. In the present we do not think that the character of the cases of necrosis that have occurred, renders it necessary to prohibit the use of white phosphorus.

But, as already indicated, there is another solution of the difficulty to which we look forward with hope. We are of opinion that an effective remedy can be found in automatic machinery with exhaust ventilation so arranged (1) that the whole of the fumes generated are completely carried off without coming in contact with the workers, and (2) that it is impossible for the paste to come in contact with the workers' hands or persons.

Pending the introduction of completely automatic machinery, it is obviously important to insist upon the greatest care being taken with regard to the very few persons in this factory who are exposed to phosphorus.

We, therefore, recommend first that the Special Rules in force in lucifer match factories using white phosphorus should be strengthened in the directions indicated above, and, secondly, that the various firms engaged in that industry should be pressed to arrange for automatic machinery which shall completely isolate the operatives both from fumes and from the paste. With this object a further conference might be useful. We have referred elsewhere to the detailed enquiries now being made by the Department. We would further suggest that an inquest should always be held in case of a fatality attributable to phosphorus, and that the attention of Coroners should be especially directed to this point.

We are, Sir,

Your obedient Servants,

HENRY CUNYNGHAME.

B. A WHITELEGGE.

February 22*nd*, 1907.

The Rt. Hon. H. J. Gladstone, M.P.,
His Majesty's Principal Secretary of State
for the Home Department.